

A Simple Smoke-Detector Interlock Box

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Introduction

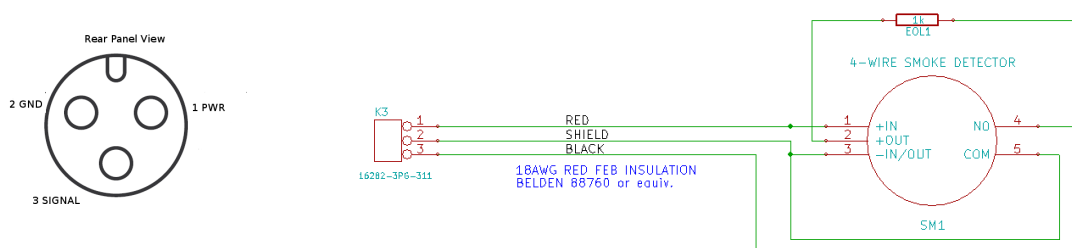
There is a need for a simple, low cost rack protection system (RPS) that will interface to a smoke detector and control an interlock signal. If smoke is detected in the rack the RPS box will drop the interlock and a separate AC distribution unit will interrupt power to rack components. In some racks a UPS is also used, so the proposed RPS interface unit must also provide a contact closure output that will force the UPS to immediately power off and disconnect if smoke is detected.

Requirements

- Simple, hardware only. No programmable logic, CPU, or software may be used.
- Uses a standard 4-wire smoke detector (photometric or ionization type)
- Powered from 120VAC
- 12VDC interlock output
- Interlock LED indicator
- UPS Emergency Power Off (EPO) contact closure output
- 1U rack mounted chassis
- Pushbutton reset
- Audible alarm indication

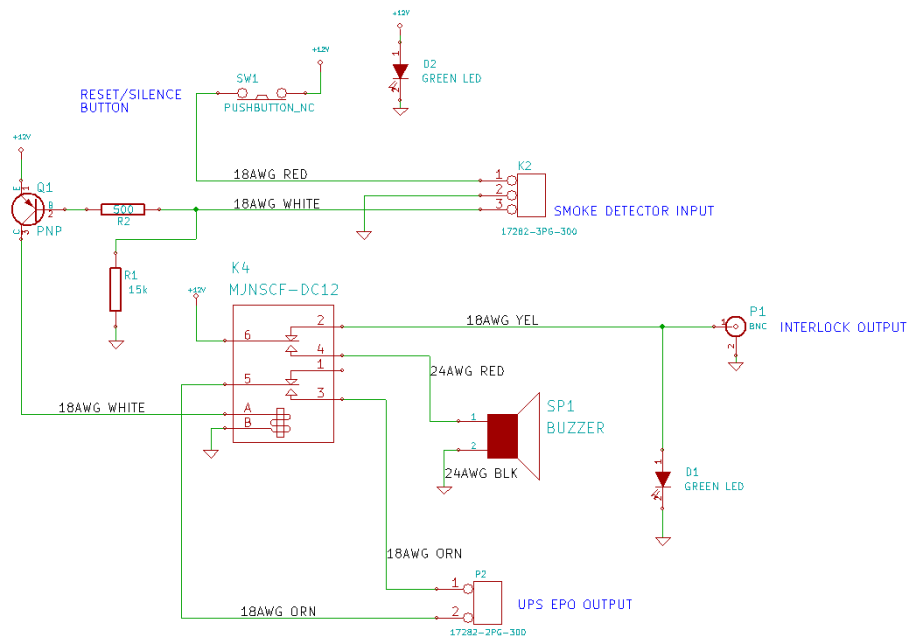
Circuit Description

A standard 4-wire smoke-detector requires 12VDC and provides a set of normally-open contacts. When smoke is detected the contacts close and remain closed until the detector power is interrupted. A normally-open contact smoke detector has one major problem -- it is not possible to distinguish between a normally operating smoke detector and one that has become disconnected from the RMI. Therefore a pull-up resistor has been added to the smoke detector as follows:



So normally the RMI will see a 1k ohm pullup to 12VDC on connector K3 pin 3. If the detector trips connector K3 pin 3 will be connected hard to ground. If the detector is not plugged in pin 3 will be floating. (Note that smoke detector pins 1 and 2 are shorted internally.)

The RMI circuit is shown below:



A PNP power transistor and bias resistors are used to drive a DPDT relay. If the detector is not plugged in current flows through R2 and R1 and saturates the transistor, energizing the relay (fault condition). If the detector is plugged and in normal operating mode in its 1k pullup resistor forces the transistor into cut-off and de-energizes the relay. If the detector trips current will flow through R2 and R1 and energize the relay.

Detector	Relay	Interlock Output	UPS EPO
Normal	off	+12VDC	Open
Tripped	on	0V	Closed

Press and hold the normally-closed button for a few seconds to reset the smoke detector.

A small low-wattage 12VDC switching supply powers the circuit.
The output is current limited to 1A.

Cost

Total cost for this unit is approximately \$200 plus labor to assemble.